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the chromosomes in this mitosis move independently of any spindle.—C. J. CHAMBERLAIN.

**Studies in ferns.**—Apogamy in *Cystopteris fragilis*, hybridization in *Asplenium*, and conditions of heredity in certain ferns, have been investigated by A. HEILBRONN.<sup>19</sup> The group last considered includes, as true varieties, the following: *Aspidium Filix-mas* var. *grandiceps*, *A. aculeatum* var. *cruciato-polydactylum*, *Athyrium Filix-femina* var. *corymbiferum*, *A. Filix-femina* var. *multifidum*, *A. Filix-femina* f. *multifidum Mapple-Beckii*, *A. Filix-femina* var. *laciniatum* and var. *purpureum* Lowe. Others not considered true varieties are *Athyrium Filix-femina* var. *Fieldiae* Moore, *A. Filix-femina* f. *multifidum minus*, and *Aspidium angulare* f. *grandidens*. The general conclusions of the author are: (1) *Cystopteris fragilis* f. *polyapogama* develops prothallia which show the power of developing sporophytes from unfertilized egg cells or by vegetative apogamy, the two cases sometimes being side by side; (2) the question as to whether *Asplenium germanicum* is a hybrid between two forms is not yet settled, but by crossing *Asplenium septentrionale* (female) and *A. Ruta-muraria* (male), a plant was obtained which stands nearer to *A. germanicum* than any other known form; (3) some fern-forms which had not been investigated before appear apogamous. Of the different forms of *Athyrium Filix-femina* from England, some are true varieties and some revert. Attempts to obtain forkings artificially were unsuccessful.—NORMA E. PFEIFFER.

**Water-cultures of fern prothallia.**—In a short paper H. FISCHER<sup>20</sup> gives some of his results with the germination of fern spores, in obtaining material for his work on variation, hybridization, etc. He states the advantages of water-cultures over solid substrata as being threefold: the chemical constitution can be regulated; the cultures are cleaner, and material is fit for microtome sections without extra care; the spores may be sowed as thick as desirable, and easily diluted, like a solution, if too close together on germination. The danger lies in the drying out of cultures, or too great evaporation, resulting in plasmolysis. A second danger lies in the production of abnormal forms by too deep layers. The author recommends Pfeffer's nutrient solution and Arthur Meyer's solution, the formula of which he gives. He finds that changing one compound or its concentration, changing the reaction of a solution, etc., often produce the desired germination. But evidently there is no general rule for this, as there is none for the length of time after ripening that a spore will germinate. In *Asplenium Serra*, herbarium material germinated after 48 years. In some few cases the author is as yet unable to induce germination.—NORMA E. PFEIFFER.

<sup>19</sup> HEILBRONN, ALFRED, Apogamie, Bastardierung, und Erblichkeitsverhältnisse bei einigen Farnen. *Flora* (n.s.) 1: 1-42. figs. 43. 1910.

<sup>20</sup> FISCHER, HUGO, Wasserkulturen von Farnprothallien, mit Bemerkungen über die Bedingungen der Sporenkeimung. *Beih. Bot. Centralbl.* 27: 54-59. 1911.